OPERATING INSTRUCTIONS

FOR THE

UNIVERTER TYPE 203-B

BOONTON RADIO COMPANY
ROCKAWAY, NEW JERSEY
U. S. A.

2C/12-62/CP

(Printed in U.S.A.)

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TYPE 203-B UNIVERTER

1. INTRODUCTION.

a. GENERAL.

The Type 203-B Univerter, a frequency converter accessory having unity gain, is designed for use with the 240-A Sweep Sig. Gen. to provide additional frequency coverage from 0.1 mc. to 25 mc. Since the 240-A Sweep Sig. Gen. covers a frequency range from 4.5 to 120 megacycles, the 203-B offers a simple and convenient means whereby the additional coverage of commonly used intermediate and radio frequencies may be obtained. This instrument also enables the sweep and amplitude modulation features of the 240-A instrument, as well as the attenuator calibration, to be utilized at these lower frequencies without causing appreciable distortion.

This instrument consists essentially of a front panel assembly, RF sub-chassis and regulated power supply. The power supply chassis is secured to the bottom of the equipment cabinet and connections to the RF subchassis and panel assembly are made with a cable and plug arrangement.

The 203-B Univerter is both lightweight and compact, matching the 240-A Sweep Sig. Gen. in proportions and finish. A collapsible leather handle is attached to the top of the generator cabinet for convenience in carrying.

b. BASIC OPERATION PRINCIPLES:

Figure 2 shows in block form the basic circuit elements of the 203-B Univerter. One triode section of a 6J6 (V1A) functions as a local 70 mc. oscillator and feeds into the second 6J6 (V1B) section which serves to mix this 70 mc. oscillator signal and the incoming RF signal from the 240-A Sweep Sig. Gen. in order to obtain a difference frequency.

The frequency of the 70 mc. oscillator is manually adjustable over a small range of ±250 kc. by means of a frequency deviation dial on the front panel of the instrument. This dial is calibrated at 10 kc. intervals permitting relatively small changes in output frequency to be made such as are required for selectivity measurements.

Following the mixer stage are two wide band amplifier stages which provide uniform amplification of this difference frequency within the pass band of the instrument.

The output stage serves the twofold function of providing a low impedance degenerative output of approximately 50 ohms (X1 OUTPUT) and a higher impedance output of 470 ohms (2 V. MAX.).

The overall gain of the Univerter system is factory adjusted to unity to permit the use of the RF output

Fig. 1. Front View of 203-B Univerter

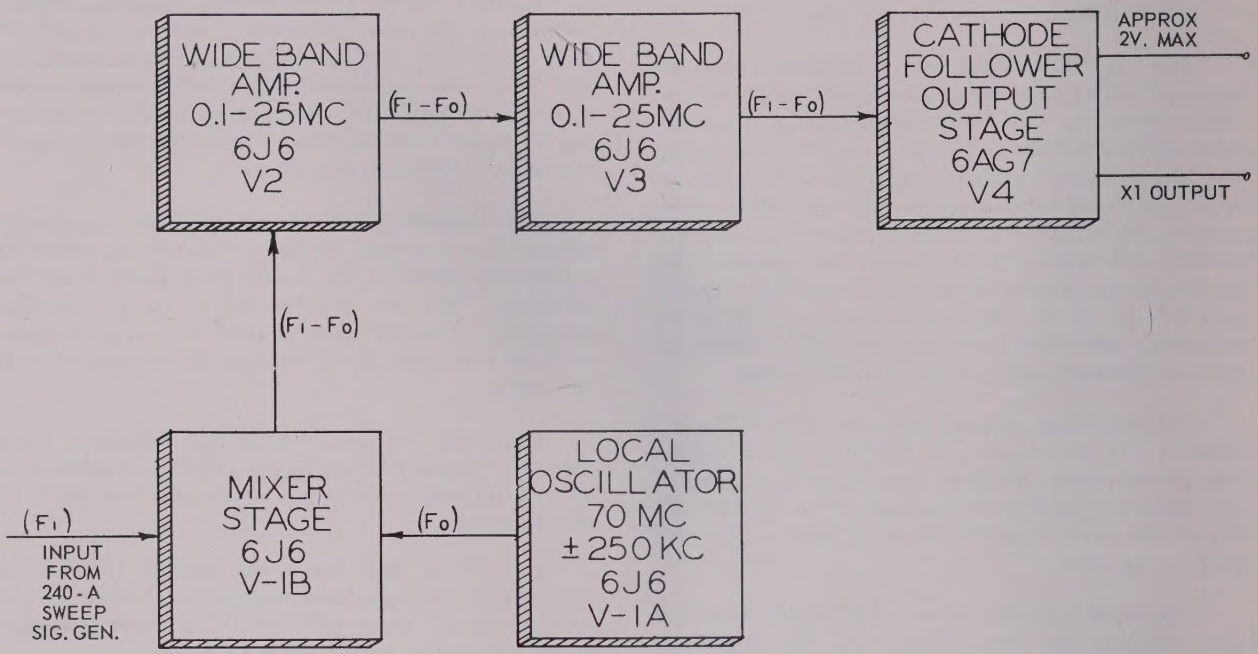

WIDE BAND AMP. 0.1-25MC 6J6 V2
(F1 - Fo)
WIDE BAND AMP. 0.1-25MC 6J6 V3
(F1 - Fo)
CATHODE FOLLOWER OUTPUT STAGE 6AG7 V4
APPROX 2V. MAX
X1 OUTPUT
(F1 - Fo)
(F1)
INPUT FROM 240-A SWEEP SIG. GEN.
MIXER STAGE 6J6 V-1B
(Fo)
LOCAL OSCILLATOR 70 MC ±250 KC 6J6 V-1A

Fig. 2. Basic Elements of 203-B Univerter

attenuator of the 240-A Sweep Sig. Gen. over the range from 1 microvolt to 0.1 volt in order to obtain a known voltage at the terminals of the RF output cable assembly. In addition, a maximum of approximately 2 volts (uncalibrated) may be obtained at the front panel 2 V. MAX. pin jack.

2. OPERATING INSTRUCTIONS.

a. SETUP.

To use the 203-B Univerter with the 240-A Sweep Sig. Gen., plug in the BNC connector of the Univerter cable at the RF output jack of the 240-A instrument and transfer the 501-B output cable of the 240-A generator to the X1-OUTPUT jack of the Univerter. Connect the Univerter power cord to any 115 volt, 50-60 cycles power outlet and operate the power switch to the "PWR ON" position.

Allow the instrument to warm up for a 15-20 minute period and then check the frequency of the local oscillator by obtaining zero beat at the output of the Univerter with the 240-A frequency set at 70 megacycles and the input to the Univerter reduced as far as can be tolerated, still retaining a satisfactory frequency null indication at the Univerter output. A sensitive vacuum tube voltmeter or a pair of crystal earphones can be used as a means of null indication. Capacitor C2, located on the left side of the sub-base, directly behind the front panel (see Fig. 3), is used to adjust the 70 mc. local oscillator to zero beat with the 240-A Sweep Sig. Gen.

b. OPERATING PROCEDURE.

The output frequency of the Univerter is readily determined by subtracting 70 mc. from the dial reading of the 240-A Sweep Sig. Gen. The upper frequency extremity of the 240-A which will permit frequency conversion at unity gain is 95 mc. corresponding to an output frequency of 25 mc. from the Univerter.

Since the pass band of the Univerter amplifier is linear in response down to 100 kc. an unmodulated RF carrier at this frequency will be passed without amplitude discrimination. Where the sweep condition is desired the lower frequency limit of the Univerter should be considered as 100 kc. plus the 240-A Sweep width.

For small frequency changes, in the order of 10 kc, or more, the incremental frequency dial will prove quite useful. The RF carrier may be shifted a maximum of ±250 kc. permitting a fine degree of measurement between the "birdie" markers of the 240-A.

If, for any reason, it is desired to increase or decrease the overall gain of the Univerter, this may be accomplished by means of R5 (Fig. 3) which varies the plate voltage of the mixer tube V1. Since the Univerter gain is uniform over the bandpass range, a measurement frequency of 100-150 kc. can be selected, permitting the use of a relatively low frequency vacuum tube voltmeter for output voltage measurement.

3. SPECIFICATIONS.

a. RF RANGE.

The RF range of the Univerter when used in combination with the 240-A Sweep Sig. Gen. from 0.1 mc. to 25 mc., is constant at unity gain to within ±1 db.

b. FREQUENCY INCREMENT DIAL.

This dial is calibrated in increments of 10 kc. from plus 250 kc. through zero to minus 250 kc.

c. RF OUTPUT.

The RF output voltage at the X1 panel jack is continuously variable from 1 microvolt to 0.1 volt by means of the 240-A Sweep Sig. Gen. attenuator. For 0.3 volt input to the Univerter, the output is approximately 0.28 volt. The impedance at the X1 RF OUTPUT jack, looking into the instrument is approximately 50 ohms resistive. The RF output voltage at the 2 VOLT. MAX. pin jack is uncalibrated but may be controlled from the attenuator of the 240-A Sweep Sig. Gen. At this pin jack the internal impedance is approximately 470 ohms.

d. DISTORTION.

1. FM. The Univerter introduces no appreciable distortion when a swept frequency voltage is applied from the 240-A Sweep Sig. Gen.

2. AM. At 30% amplitude modulation, 0.1 volt may be obtained from the Univerter with overall distortion, including the 240-A instrument, not in excess of 10%.

e. TUBE COMPLEMENT.

Oscillator - Mixer	6J6	(V1)
RF Amplifier	6J6	(V2, V3)
Cathode Follower - Output Amplifier	6AG7	(V4)
Rectifier	6X5	(V5)
Ballast Resistor	4-25	(R18)

f. POWER SUPPLY.

The 203-B Univerter is designed for use on 50-60 cycles, 115 volts.

g. DIMENSIONS.

H: 11½" W: 7⅜" D: 10½"

h. WEIGHT.

11 pounds.

4. THEORY OF OPERATION (Fig. 5).

a. LOCAL OSCILLATOR.

The "A" Section of a 6J6 (V1A, Fig. 5) functions as a tuned plate oscillator operating at a frequency of 70 megacycles. Vernier capacitor C1, of special construction, has a tuning range of about ±0.25 mmf. which permits the 70 megacycle center frequency to be shifted up or down the frequency spectrum a maximum of 250 kc. for selectivity measurements.

The 50 ohm output cable from the 240-A Sweep Sig. Gen. is terminated by resistor R1 which is in series with the pickup coil L3 introducing the 70 megacycle signal from the local oscillator.

b. MIXER.

Both the 240-A input signal and the 70 megacycle voltage are rectified by the 1N34 crystal and applied to the gride of the mixer tube V1B. Capacitor C4 serves to give the mixer circuit a rising gain characteristic with frequency reaching a maximum at about 98 megacycles, or a difference frequency of 28 megacycles.

c. BROAD BAND AMPLIFIERS.

The two broad band amplifier stages employing tubes V2 and V3 are series peaked by means of L6 and L7 at 23 megacycles and 28 megacycles, respectively, to extend the response of the overall system. Cathode resistors R8 and R11 introduce degeneration which improves both frequency and distortion characteristics.

d. OUTPUT STAGE

The 6AG7 output stage (V4) consists of a cathode follower type connection which provides a low impedance output lead for the X1 OUTPUT jack. The output impedance is about 50 ohms.

Coupled from the plate of V4 through L8 and C14 is the 2 V MAX output which is approximately ten times greater than the X1 output. Inductance L8 serves to peak the frequency response at the high end of the bandpass.

The 2 V MAX jack has an output impedance of approximately 470 ohms and is intended primarily for high level measurements.

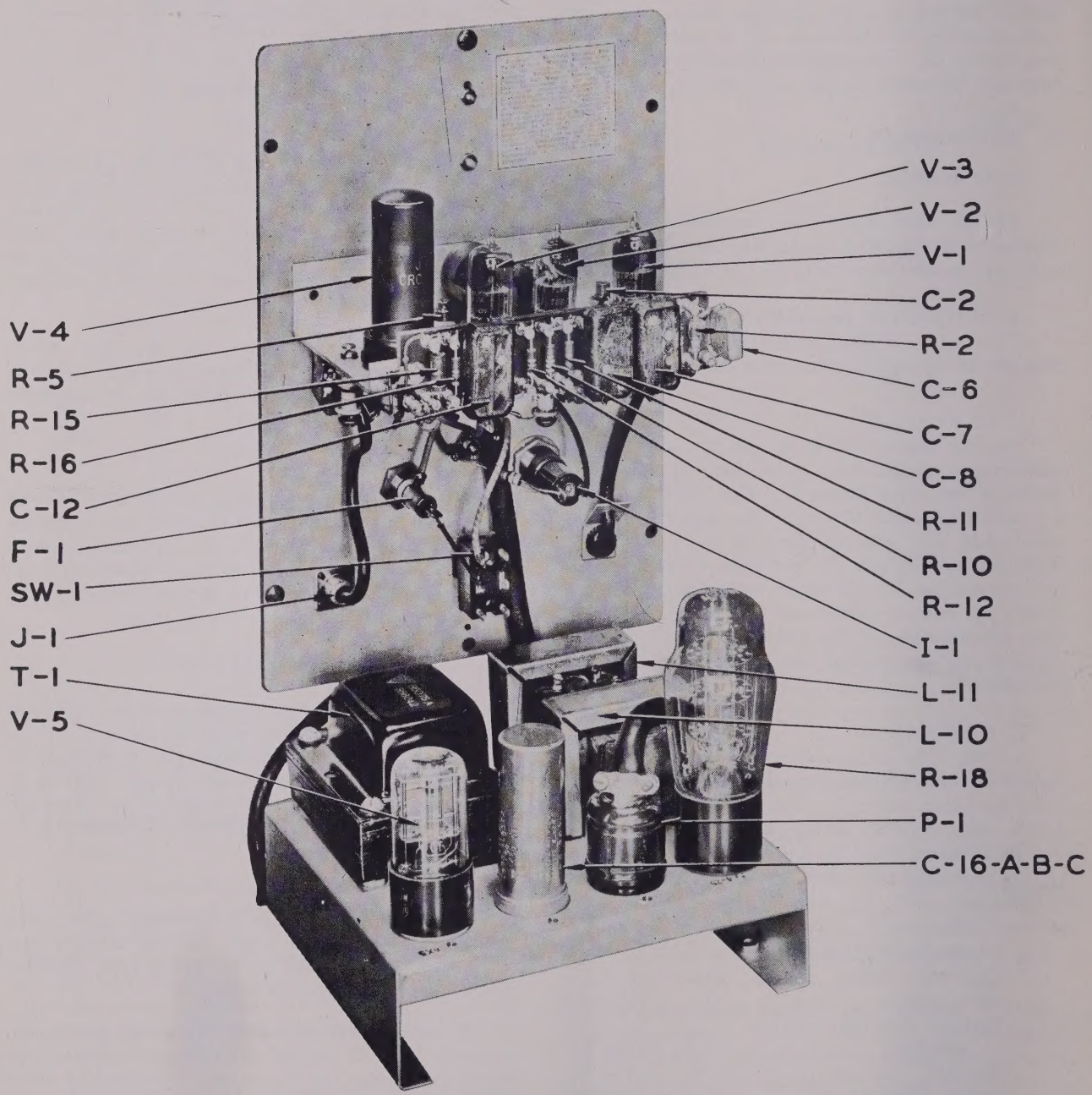


Fig. 3. Rear View of Panel Assembly and Power Unit

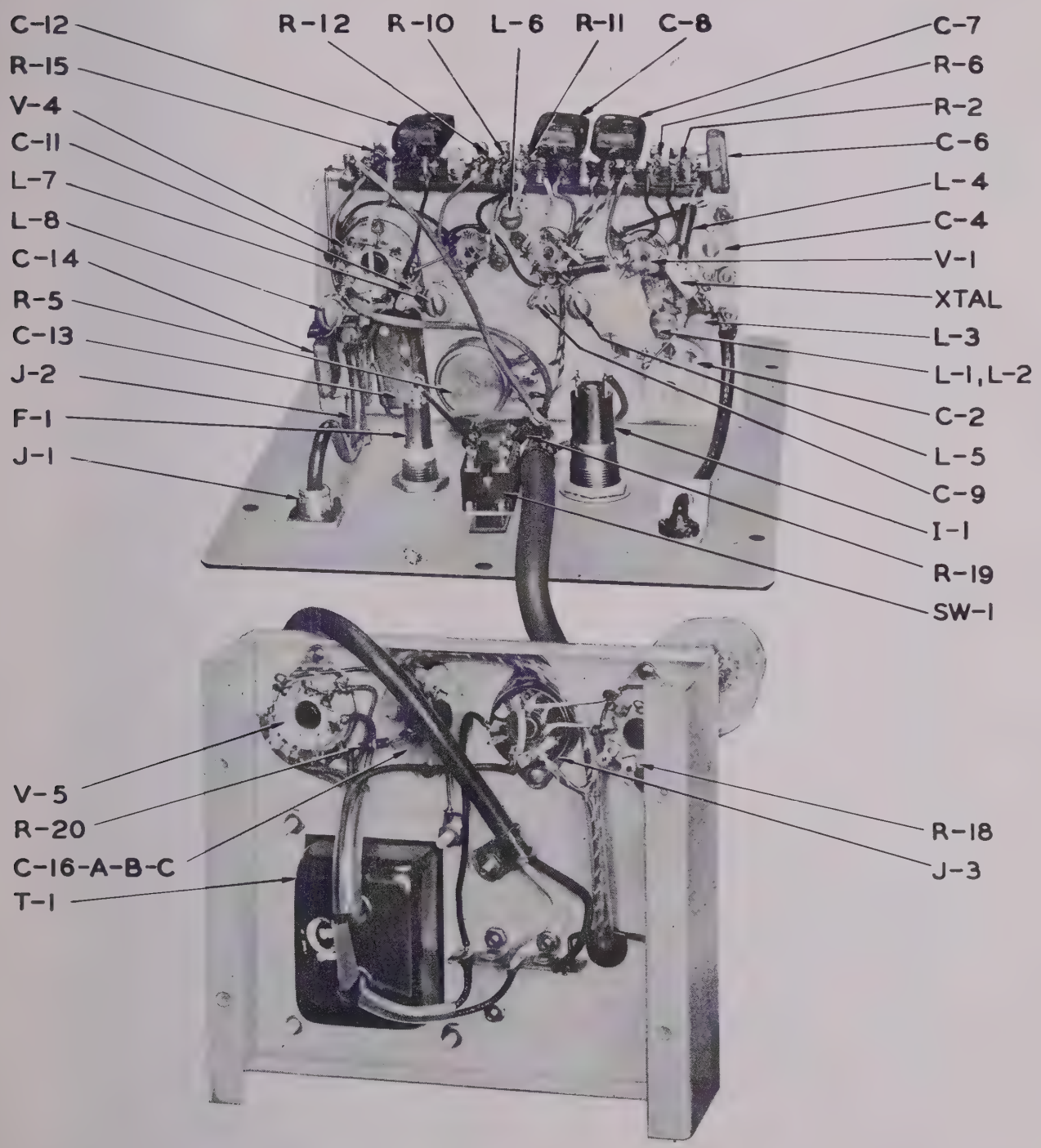


Fig. 4. Sub-Chassis View of Panel Assembly and Power Unit

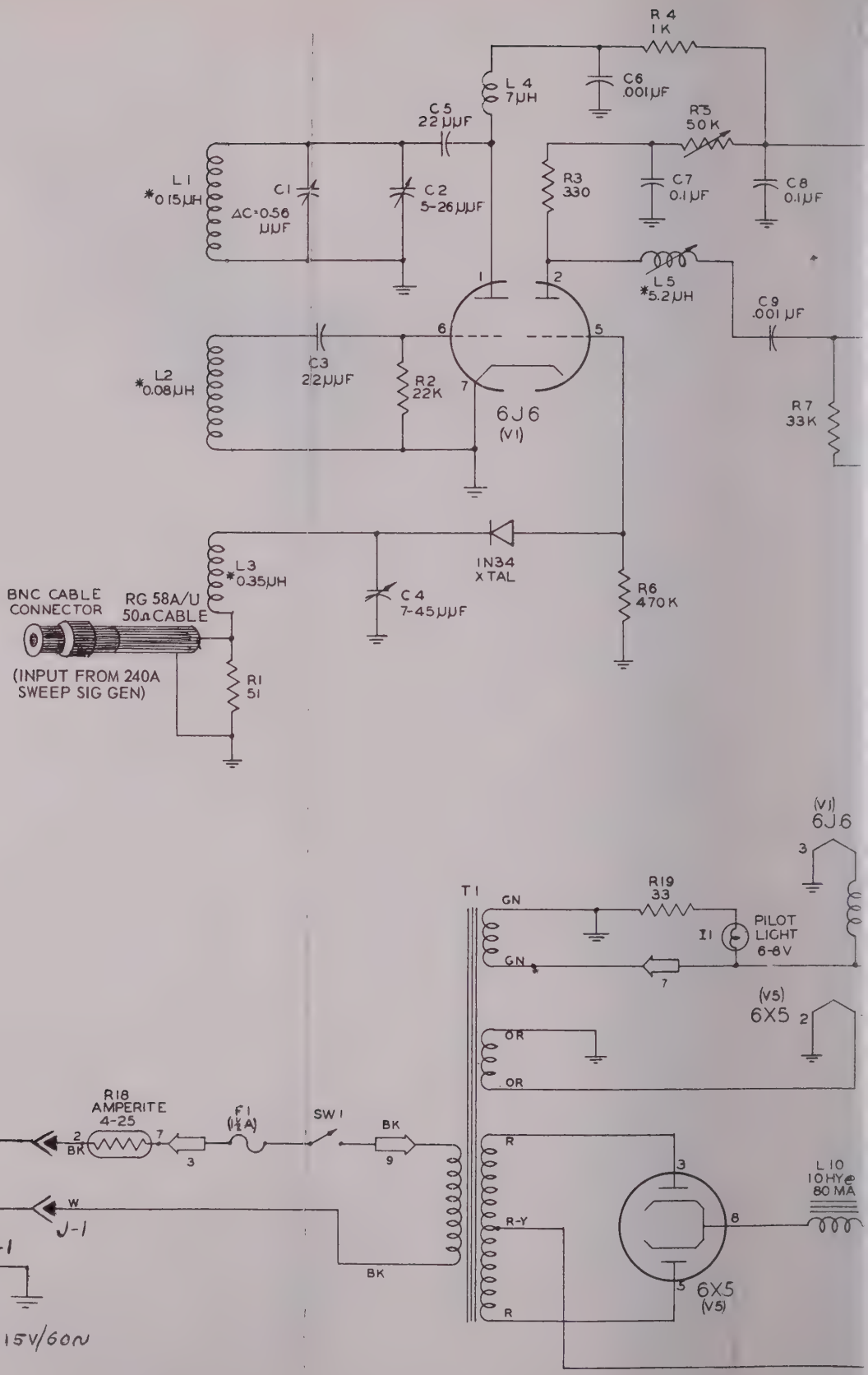
TYPE 203-B UNIVERTER

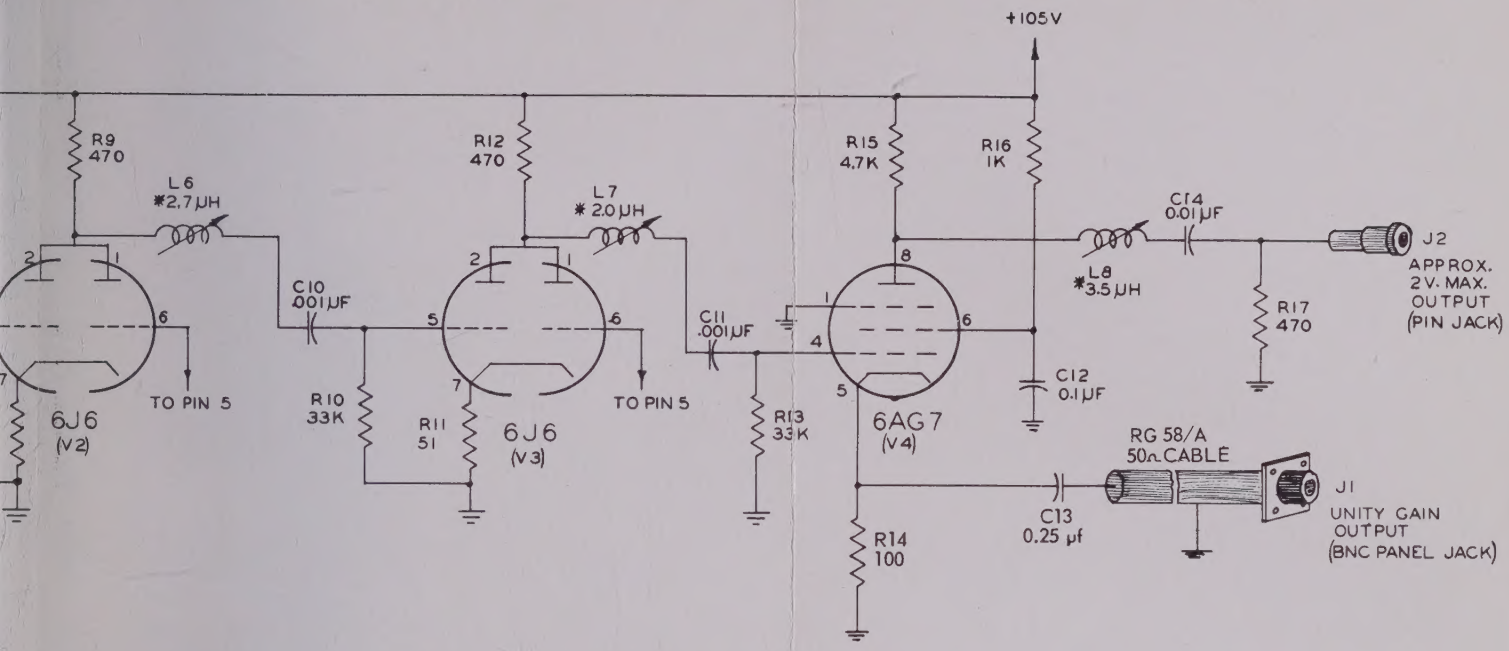
ELECTRICAL COMPONENTS PARTS LISTS

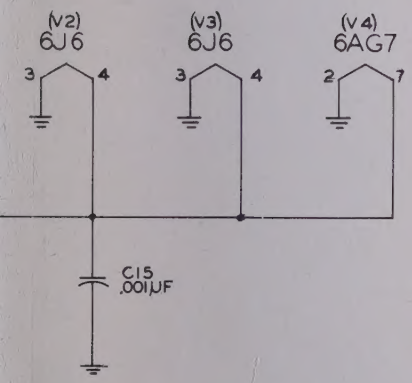
Circuit Symbol	*Value*	*Description*	*BRC Part No.*
R1	51 ohms	½ watt, ±5%	80088
R2	22K ohms	½ watt, ±5%	80472
R3	330 ohms	½ watt, ±5%	81608
R4	1K ohms	½ watt, ±5%	80148
R5	50K ohms	2 watt, variable	81408
R6	470 K ohms	½ watt, ±5%	80640
R7	33 K ohms	½ watt, ±5%	80461
R8	51 ohms	½ watt, ±5%	80088
R9	470 ohms	½ watt, ±5%	80170
R10	33 K ohms	½ watt, ±5%	80461
R11	51 ohms	½ watt, ±5%	80088
R12	470 ohms	½ watt, ±5%	80170
R13	33 K ohms	½ watt, ±5%	80461
R14	100 ohms	½ watt, ±5%	80062
R15	4700 ohms	½ watt, ±5%	80305
R16	1 K ohms	½ watt, ±5%	80148
R17	470 ohms	½ watt, ±5%	80170
R18	Amperite 4-25	Line Ballast Tube, Selected	4-25
R19	33 ohms	½ watt, ±5%	80028
R20	150 K ohms.	½ watt, ±5%	80564
C1	ΔC=.56 mmf	Frequency Increment Capacitor	300053
C2	5-26mmf	Variable Capacitor	84032
C3	22 mmf	Fixed Capacitor	82030
C4	7-45 mmf	Variable Capacitor	84039
C5	22 mmf	Fixed Capacitor	82030
C6	0.001 mf	Fixed Capacitor, Button Type	82310
C7	0.1 mf	Fixed Capacitor, Paper	83001
C8	0.1 mf	Fixed Capacitor, Paper	83001
C9	0.001 mf	Fixed Capacitor, Button Type	82310
C10	0.001 mf	Fixed Capacitor, Button Type	82310
C11	0.001 mf	Fixed Capacitor, Button Type	82310

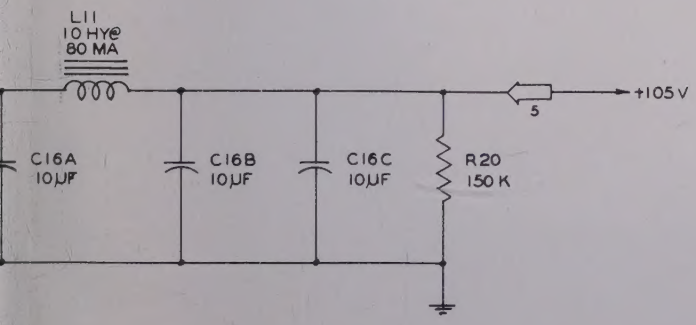
All fixed resistor made by Allen Bradley Co.

Circuit Symbol	*Value*	*Description*	*BRC Part No.*
C12	0.1 mf	Fixed Capacitor, Paper	83001
C13	0.25 mf.	Fixed Capacitor, Paper	83023
C14	0.01 mf	Fixed Capacitor	82416
C15	0.001 mf	Fixed Capacitor, Button Type	82310
C16 A,B,C	10 mf	Electrolytic 450 WV, 10-10-10 mfd	83050
1N34		Crystal	91018
J1		Connector, Receptacle: male, 3-pin	308087
L1	0.15 microhenries	Oscillator Coil Assembly	U20323
L2	0.08 microhenries	" " "	"
L3	0.35 microhenries	Mixer Pick Up Coil Assembly	U20321
L4	7.0 microhenries	Osc. R.F. Plate Choke Assembly	U20329
L5	5.2 microhenries	Peaking Coil Assembly, 1st stage	U20326
L6	2.7 microhenries	Peaking Coil Assembly, 2nd stage	U20327
L7	2.0 microhenries	Peaking Coil Assembly, 3rd stage	U20328
L8	3.5 microhenries	Peaking Coil Assembly, H. V. Out	U20333
L9	2.0 microhenries	Osc. R.F. Filter Choke Assembly	U20330
L10	10 henries @ 80 mils		85402
L11	10 henries @ 80 mils		85402
T1		Plate and Filament Transformer	85075
V1	6J6	Specially selected to individual instrument.	
V2	6J6	" " " " "	
V3	6J6	" " " " "	
V4	6AG7	" " " " "	
V5	6X5	" " " " "	
W1		Power Cord Assembly: 3-wire	308086


R4
1K
L4
7μH
C6
.001μF
C5
22μμF
R5
50K
L1
*0.15μH
C1
ΔC=0.56
μμF
C2
5-26μμF
R3
330
C7
0.1μF
C8
0.1μF
L5
*5.2μH
C9
.001μF
L2
*0.08μH
C3
2.2μμF
R2
22K
6J6
(V1)
R7
33K
L3
*0.35μH
IN34
XTAL
C4
7-45μμF
R6
470K
BNC CABLE
CONNECTOR
RG 58A/U
50Ω CABLE
(INPUT FROM 240A
SWEEP SIG GEN)
R1
51
(V1)
6J6
T1
GN
R19
33
I1
PILOT
LIGHT
6-8V
(V5)
6X5
OR
R18
AMPERITE
4-25
F1
(½A)
SW1
BK
W
J-1
W-1
R
R-Y
L10
10HY@
80MA
6X5
(V5)
115V/60~







PLUG CONNECTIONS

POWER SUPPLY CHASSIS PLUG CONNECTIONS

POINT OF SYMBOL INDICATES DIRECTION OF WIRE COMING FROM PLUG PIN INTO CABLE.

PIN 1 CONNECTED TO GROUND

PIN 7 STRAPPED TO PIN 11

RESISTANCES EXPRESSED IN OHMS

K = 1000

* = APPROXIMATE

Fig. 5. Schematic Wiring Diagram of 203-B Univerter

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